105408

Quality Assurance Project Plan
(QAPjP)

Brown's Battery
Breaking Site

Work Assignment No. 91-01-3L84
May 15, 1989

Quality Assurance Project Plan
(QAPjP)

For:

Brown's Battery Breaking Site
Tilden Township, Berks County, Pennsylvania

Prepared by:

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Prepared for:

U.S. Environmental Protection Agency
Region III

Alternative Remedial Contracts Strategy
(ARCS)

Contract No. 68-W8-001
Work Assignment No. 91-01-3684

Revision: 0

Approved by:

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John DiLoreto, Project Manager, The Earth Technology Corporation

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Alan Kaufman, Quality Assurance Officer, Black & Veatch

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George Carson, Quality Assurance Manager, Black & Veatch

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Patricia Krantz, Quality Assurance Officer, EPA

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File No. ARCS-QAP-88-001

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SECTION 3.0

INTRODUCTION

3.0 INTRODUCTION

The Remedial Investigation/Feasibility Study (RI/FS) for Brown's Battery Breaking Site, located in Berks County, Pennsylvania, is being performed through the EPA Region III, Alternative Remedial Contracts Strategy (ARCS) program. The contract number for this effort is 68-W8-001 and the work assignment number is 91-01-3684. The ARCS program is designed to allocate the responsibility and authority for RI/FS work to the region where the contaminated sites are located.

Black & Veatch Waste Management, Inc, (B&V) is the prime contractor for this effort. The Earth Technology Corporation (TETC) is a subcontracted team member under ARCS. Laboratory support will be provided through the Central Regional Laboratory (CRL)/Contract Laboratory Program (CLP) and additional laboratory facilities as needed. Additional technical support will be provided by subcontractors for activities such as well drilling and surveying.

This Quality Assurance Project Plan (QAPjP) for Brown's Battery Breaking Site identifies the objectives, organization, functional activities, and specific quality assurance (QA), and quality control (QC) activities undertaken to ensure the validity of the analytical data generated by the ARCS team and subcontractors. The purpose of the plan is to provide that all technical data generated for Brown's Battery Breaking Site are accurate, representative, and will ultimately withstand judicial scrutiny.

Specific work procedures are outlined in the Work Plan (WP) and Sampling and Analysis Plan (SAP) for this project. Together, the QAPjP, SAP, and WP produce an effective data acquisition and control program. The Health and Safety Plan (HSP) designed for this site outlines additional protocols which will be followed during all field sampling events.

All QA/QC procedures contained in this document have been prepared in accordance with professional technical standards, and applicable federal, state, and local requirements, regulations and guidelines. This QAPjP follows the guidelines provided in Interim Guidelines and Specifications for preparing Quality Assurance Project Plans, QAMS-005/80, USEPA, December 28, 1980.

3.1 PROJECT DESCRIPTION

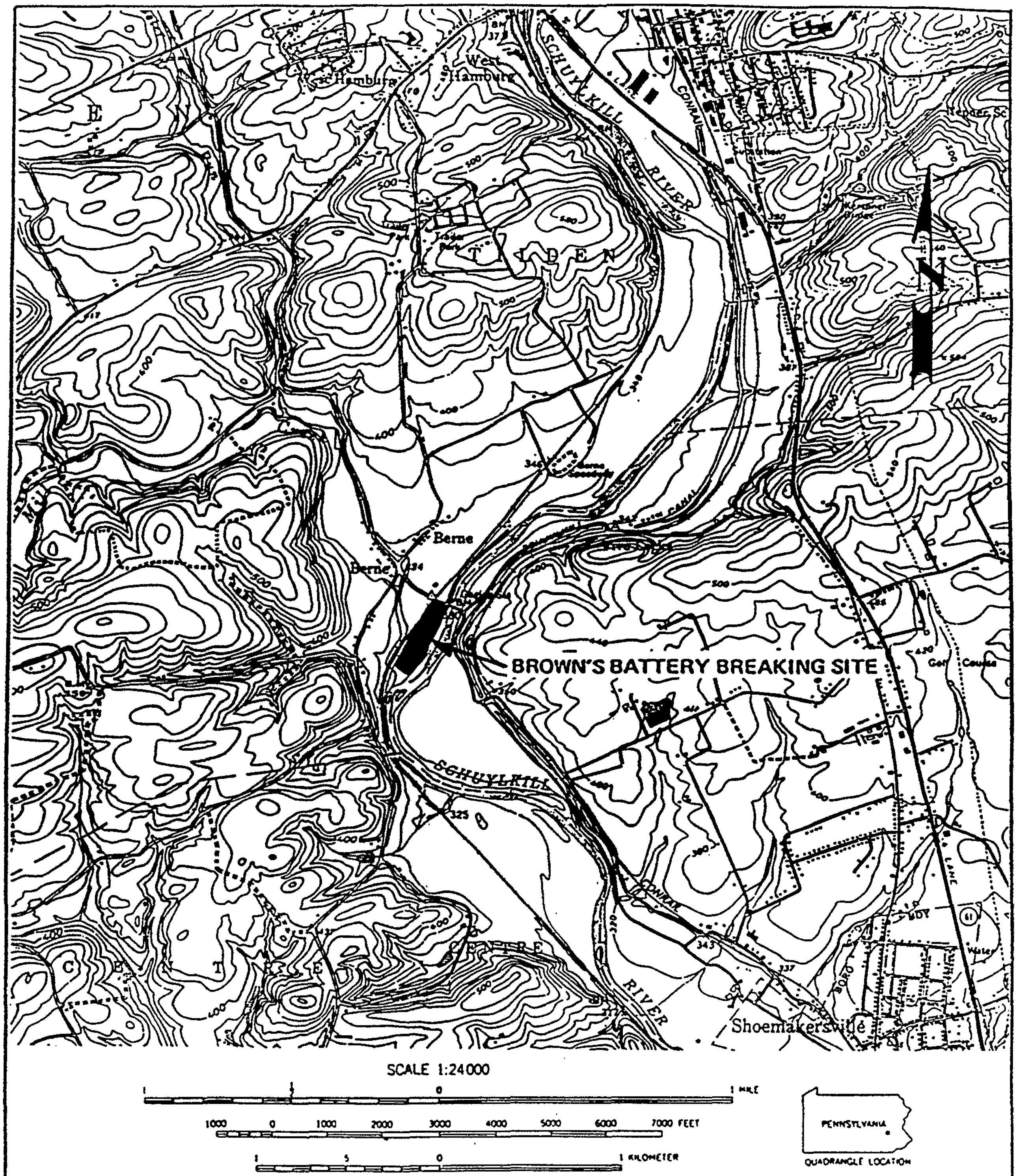
The Brown's Battery Breaking Site, an abandoned battery lead recycling facility, approximately 14 acres in size, is located in Tilden Township, Berks County, Pennsylvania (Figure 3-1). This property was owned by Robert and Barbara Brown until December of 1977, when it was purchased by Terry and Susan Shaner. The Shaners lease dwellings on their property to three families, the Stuebners, the Leibenspers, and the Straussers. Mr. Gary Blett resides in a trailer on site. An auto body shop is also located on the site.

The facility, which operated for a decade from 1961 through 1971, processed waste batteries by breaking the vulcanized rubber battery casings, draining the acid from the batteries and recovering the lead alloy grids, plates and posts from the batteries. The empty battery casings were initially disposed of on the property in the primary disposal area adjacent to the railroad tracks and Mill Creek (Figure 3-2). A later change in the breakage process resulted in smaller pieces (2" to 5") of battery casings and a more compact fill (Ref. 2). These materials were used as a substitute for road gravel and fill on this site and other sites in the area (Ref. 3).

Sampling of surface water, sediment, soils, and groundwater at the site has been conducted on several occasions by the Pennsylvania Department of Environmental Resources (PA DER) (June 24, 1980 and January through June, 1983) and EPA (several sampling episodes in 1983). Also, the Pennsylvania Department of Health (PA DOH) sampled blood levels of the children living on the site. Surface water, sediments and soils on-site contain elevated levels of lead; however, no lead has been detected in groundwater samples to date.

The EPA initiated immediate removal (IR) activities on-site in November, 1983. The activities completed by IT Enviroscience in June, 1984 included:

- Temporary relocation of the three families residing on the site.
- Immediate Removal Feasibility Study.
- Installation of security fencing.
- Removal of contaminated soils from around the residential areas and deposition of these soils in the primary disposal area.



Sources: USGS, 1979, Auburn 7.5 minute series Quadrangle and USGS, 1977, Hamburg 7.5 minute series Quadrangle.

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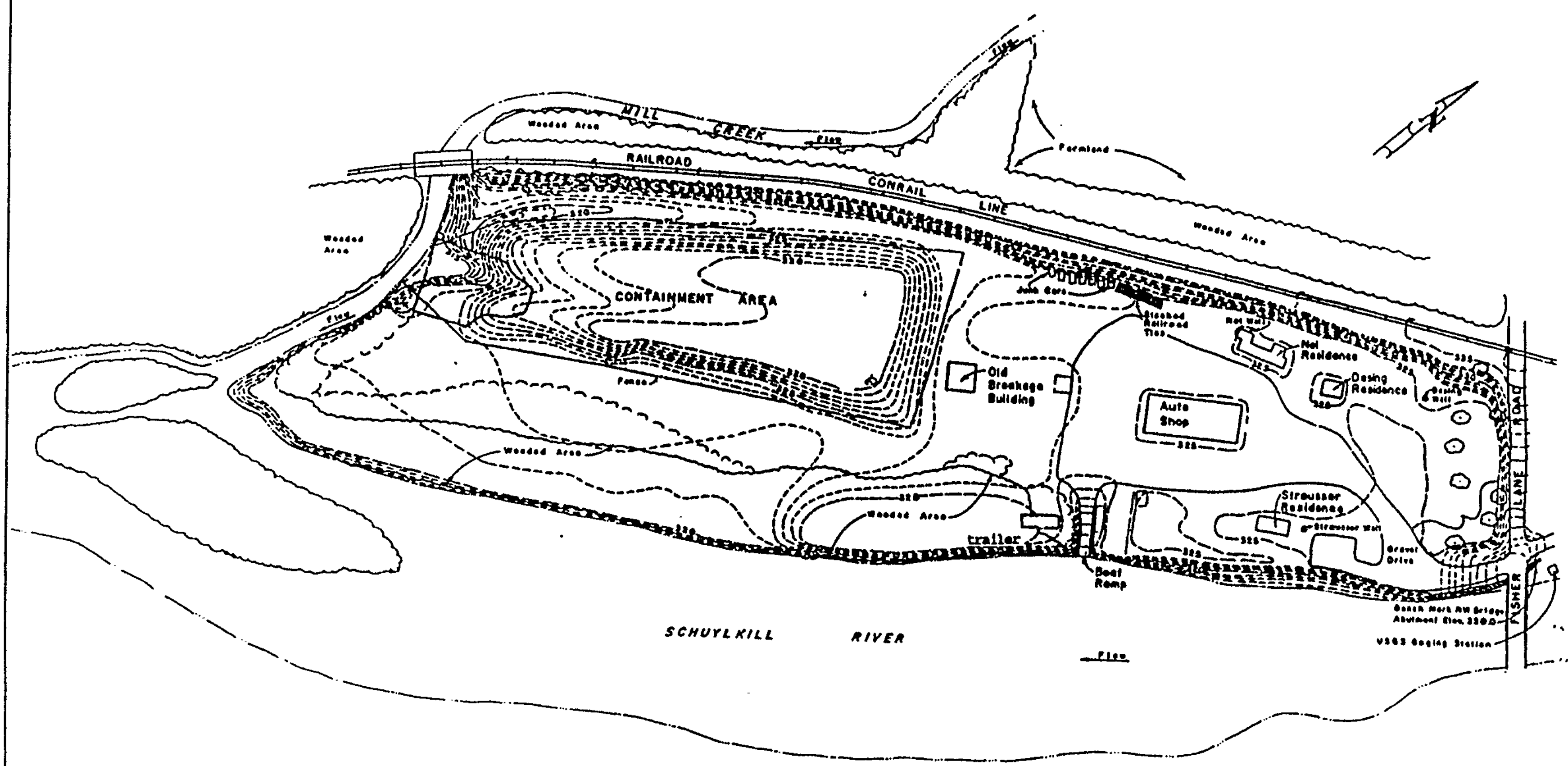
Figure 3-1

Brown's Battery Breaking Site
Location Map



Scale: None
Source: Modified from land survey performed for Environmental Response Team, June 1984

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Figure 3-2

Site Layout Map

- o Backfilling of excavated areas.
- o Capping of the primary disposal area.
- o Spreading of topsoil and seeding.
- o Return of the three families to their homes onsite.

Samples collected during the IR were analyzed by EPA Central Regional Laboratory (CRL) in Annapolis, Maryland. The analytical results showed elevated levels of lead in both the soil and surface water samples. Levels of 26,000 parts per million (ppm) and 57,500 ppm lead were found in soil composites taken along the access road on site and in the property driveway, respectively. Lead levels of 3,130 ppm, 1,120 ppm, and 84,200 ppm were detected in soil samples taken around the three residences.

Composite soil samples taken from the primary disposal area yielded up to 20,100 ppm lead at a depth of 2.5 feet and up to 378,000 ppm lead at 1.5 feet. These soil samples were collected below deposited battery casings. A soil sample collected between the primary disposal area and the Schuylkill River contained 6,830 ppm lead.

The EPA Removal Program investigation identified two main contaminant areas (based on the extent of battery casings only) and several smaller areas. The primary disposal area was located along the railroad line on the northwestern site boundary. The second major disposal area was located in the vicinity of the residences and garage in the northeast portion of the site, where crushed casing material had been deposited as a roadway surface.

Uncrushed casings were also found on the bank of the Schuylkill River, and on the banks of and within Mill Creek. EPA initially estimated the total volume of casings in the primary disposal area to be approximately 26,000 cubic yards. Analyses of composite casing samples yielded lead concentrations of 201,000 to 378,000 ppm.

Water samples taken from the Schuylkill River yielded levels of lead up to 0.133 ppm. Lead was not detected in the two domestic drinking water wells at the Strausser and Desing residences.

Air monitoring was performed by the EPA's Environmental Response Team (ERT) on September 17, 1983. The ERT employed air filters sensitive to lead and a real time air monitoring instrument (RAM-1). Analysis of the filters revealed low levels of lead in the atmosphere, while the RAM-1 measurements failed to show particulates above background levels.

Following receipt and review of the analytical results, the EPA and the Centers for Disease Control (CDC) declared that an imminent danger existed to the public health and environment. The On-Scene Coordinator (OSC) contacted Mr. Shaner and informed him of the site investigation findings. A CERCLA Immediate Removal request was made to EPA headquarters on October 6, 1983 and approved on October 20, 1983.

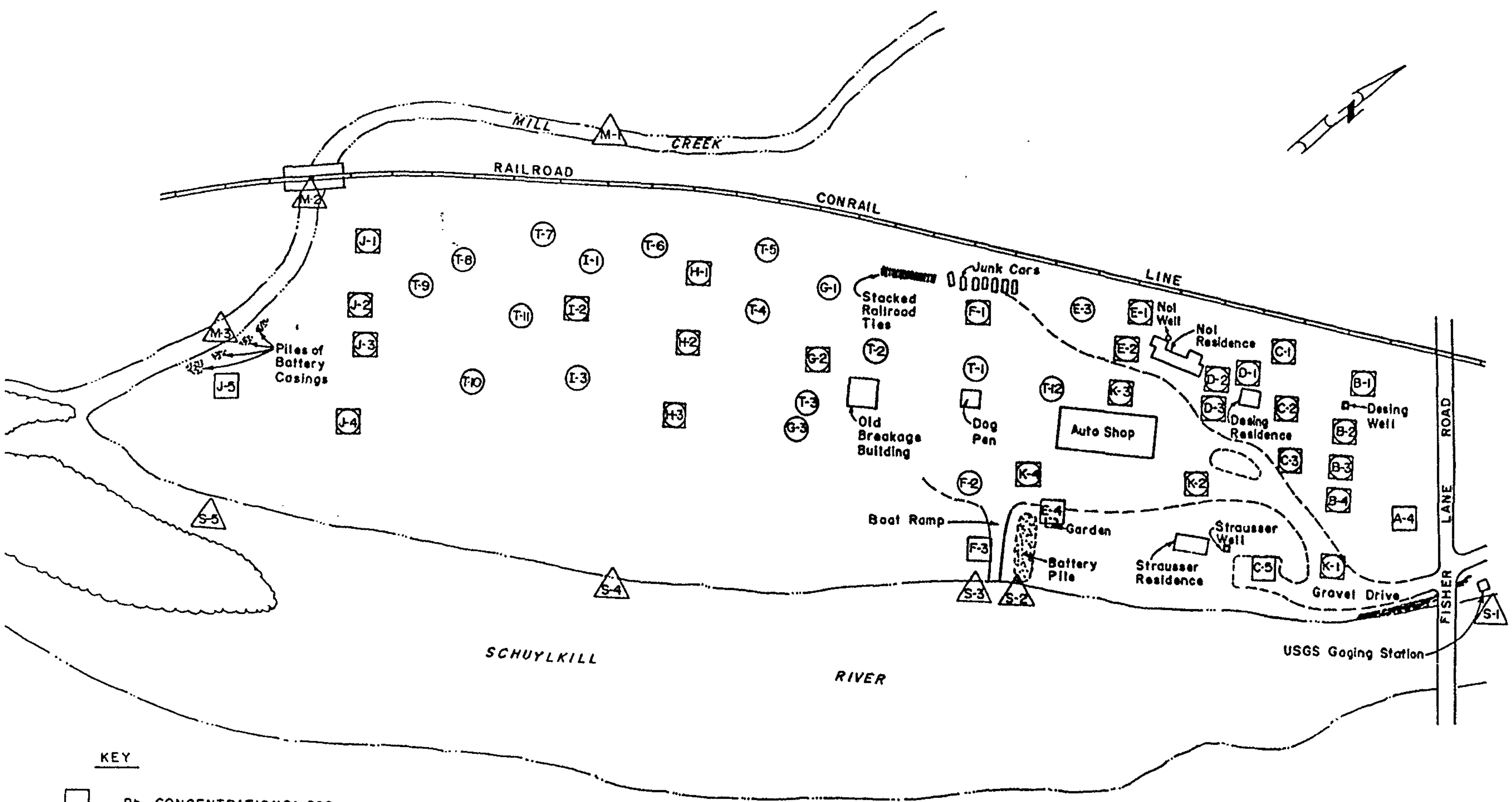
Work to further investigate the site resumed on October 31, 1983. By November a field investigation was performed to determine the extent of the contamination (an EOC survey). This investigation included sampling soil, sediment, air, surface water, ground water, vegetation and battery casings. These samples, along with a mapping survey, were used to initiate a Removal feasibility study. The final EOC and feasibility study were submitted to the OSC on December 21, 1983 (Ref. 1).

The EOC survey concluded that the battery casings and contaminated soils on the Brown's Battery Breaking Site were a significant source of lead contamination. Adverse impacts had already been demonstrated by the elevated levels of lead detected in the blood of the children living at the site. It was determined that the health of residents may be adversely impacted by ingestion of lead-contaminated vegetables, inhalation of lead dust, direct contact with soil and incidental ingestion of soil.

The presence of elevated lead levels in surface water and sediments demonstrated the transport of lead off-site (Figure 3-3, Table 3-1). High concentrations of lead were found in filterable particulates and leachate generated via shaker extraction tests on battery casings, demonstrating the significant potential for off-site transport during rainfall events.

Due to the location of the site within the 10-year floodplain, the exposed waste and contaminated soils are potentially saturated at times, thus increasing the potential for transport of lead offsite.

The Removal feasibility study recommended the excavation of casings and contaminated soils and placement within a Containment Area capped with clay soil and stabilized with vegetation. The removal feasibility study also determined ground water contamination from the site was not an immediate hazard.



KEY

- □ Pb CONCENTRATIONS > 500 ppm
- ○ BATTERY CASINGS FOUND AT SITE
- △ SEDIMENT/SURFACE WATER SAMPLING SITE (SEE DATA ON FOLLOWING SHEET)

Scale: None
Source: Modified from land survey performed for Environmental Response Team, June 1984

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Figure 3-3

Previously Identified Areas of Contamination

TABLE 3-1

PREVIOUSLY IDENTIFIED SURFACE WATER AND SEDIMENT LEAD CONCENTRATIONS

Sample Location	Sediment Lead Concentration (mg/L)	Water Pb Concentration (mg/L)
S-1	307	<0.02
S-2	710	0.053
S-3	1440	0.55
S-4	71.3	0.124
S-5	168	0.133
M-1	114	0.09
M-2	112	0.08
M-3	.338	<0.02

EPA Removal activities were performed in accordance with the feasibility study recommendations. The contaminated soil and battery casings were removed to the Containment Area (see Figure 3-2), covered with a clay cap, graded and revegetated. The Containment Area was graded to a height of 6 to 8 feet above the site surface and encircled by a chainlink fence. Further information regarding these activities is detailed in the file material (Refs. 1, 2, and 3). Due to the immediate risk passed by the battery casings the IR sampling program was not designed to provide a complete characterization of the containments present on the Brown's Battery site property. Therefore in order to fully determine potential risks to human health and the environment an RI/FS is necessary.

Since the completion of the EPA removal action, potentially responsible parties have declined to complete an RI/FS addressing the site, which has been placed on the Superfund National Priorities List. Subsequent visits to the site (Refs. 15, 20) revealed the existence of cracks in the Containment Area and surface soils outside the Containment Area littered with battery casing pieces. EPA has assumed full responsibility for performing the RI/FS.

No additional sampling is known to have been conducted at the site since the IR activities were completed.

In January, 1986, a Remedial Investigation/Feasibility Study (RI/FS) work plan was prepared by Ecology and Environment, Inc. for PA DER. In July, 1987, General Battery Corporation (GBC), the principal client of Brown's Battery Breaking, entered into an Administrative Order on Consent (Consent Order) with EPA to conduct the RI/FS.

GBC's Contractor prepared a work plan for the RI/FS in August, 1987, however, EPA's technical review of the work plan resulted in a number of comments being incorporated in the final work plan. After a series of technical meetings and correspondence between EPA and GBC, EPA released GBC from obligations under the Consent Order and elected to conduct the work with EPA resources.

The primary activity known to have contributed to the environmental contamination at the Brown's Battery Breaking Site involves the onsite breaking of batteries and dumping of sulphuric acid containing lead and antimony, onto the ground. It is unknown if the site was used for other purposes which could have contributed to the contamination of the site or surrounding waterways.

3.2 Purpose and Objectives

The primary objective of the present work effort is to identify the most cost effective remediation plan for Brown's Battery Breaking Site which successfully mitigates potential impacts on the environment and public health. This will be accomplished through the completion of a remedial investigation (RI) and feasibility study (FS) which conforms to EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (Interim Final 1988). The RI/FS will (1) characterize the current extent of contamination on the site and the actual or potential hazard to the public health and environment, and (2) effectively develop and evaluate remedial alternatives.

Data collected during the EOC survey provides baseline information on contamination around the site. The validity of this historic data has not been confirmed and it is therefore considered qualitatively rather than quantitatively. For additional information regarding previous sampling sites and results, refer to the On-Scene Coordinator's Report (OSC) and EOC report (EPA, November 1983).

As a result of the sampling for the proposed work, the following will be accomplished:

- The extent of soil contamination from lead, antimony or Target Analyte List (TAL) inorganics on the site and in the nearby sediments of Mill Creek and the Schuylkill River will be determined.

- The total mass of contaminated soil remaining on the site, both within the primary containment area and outside of the primary containment area, will be delineated.

- Baseline soil and water characteristics will be established which will allow the determination and cost comparison of remedial alternatives for this site.

- Aquifer depth(s), direction of flow, thickness of confinement layer(s)/water bearing layer(s), and current contamination levels will be characterized.

- The amount of contamination in Mill Creek and the Schuylkill River water resulting from pollution migration from this site will be estimated.

- Impacts on the surrounding air quality from contaminants on this site will be estimated.

The goals for selecting the remedial alternatives include:

- Provide a cost-effective remedy.
- Attain state and federal potentially Applicable or Relevant and Appropriate Requirements (ARAR's).
- Select a remedy that uses permanent solutions and alternative technologies to the maximum extent practicable.
- Consider the use of interim responses.
- Use on-site mitigation to the maximum extent possible.

SECTION 4.0

PROJECT ORGANIZATION AND RESPONSIBILITY

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Figure 4-1 illustrates the ARCS Team Quality Assurance Program organization. B&V, TETC and EPA participants are included in this organizational plan. The management structure provides for direct and constant operational responsibility, clear lines of authority, and the integration of QA activities. The various QA functions are explained below.

B&V is the prime contractor for this effort and maintains overall project management and QA responsibility. TETC is a subcontracted team member who will provide technical expertise in the areas of site sampling, health and safety, and data validation. The address for B&V appears on the front of this plan. TETC personnel can be contacted at 300 N. Washington, Street, Alexandria, Virginia 22314, 703-549-8728.

4.1 PROGRAM MANAGER

Mr. David Wright (B&V) is the Program Manager for the B & V ARCS III contracts. As Program Manager, Mr. Wright is responsible for overall direction, coordination, technical consistency, and review of the entire contract. His responsibilities include:

1. Final approval and review of work plans, project deliverables, schedules, contract changes, and manpower allocations for each task.

2. Guiding the resolution of problems that may arise on each task.

3. Approving satisfactory completion of each work element in each task.

4.2 DEPUTY PROGRAM MANAGER

Mr. Doug Hazelwood (TETC) will serve as the Deputy Program Manager. Mr. Hazelwood will participate in the budgetary and cost control functions for the project. He will also aid technology transfer and review technical standards in both the planning and sampling stages of this project. His primary responsibilities will include but not be limited to:

1. Ensuring coordination among management, field teams, and support personnel.

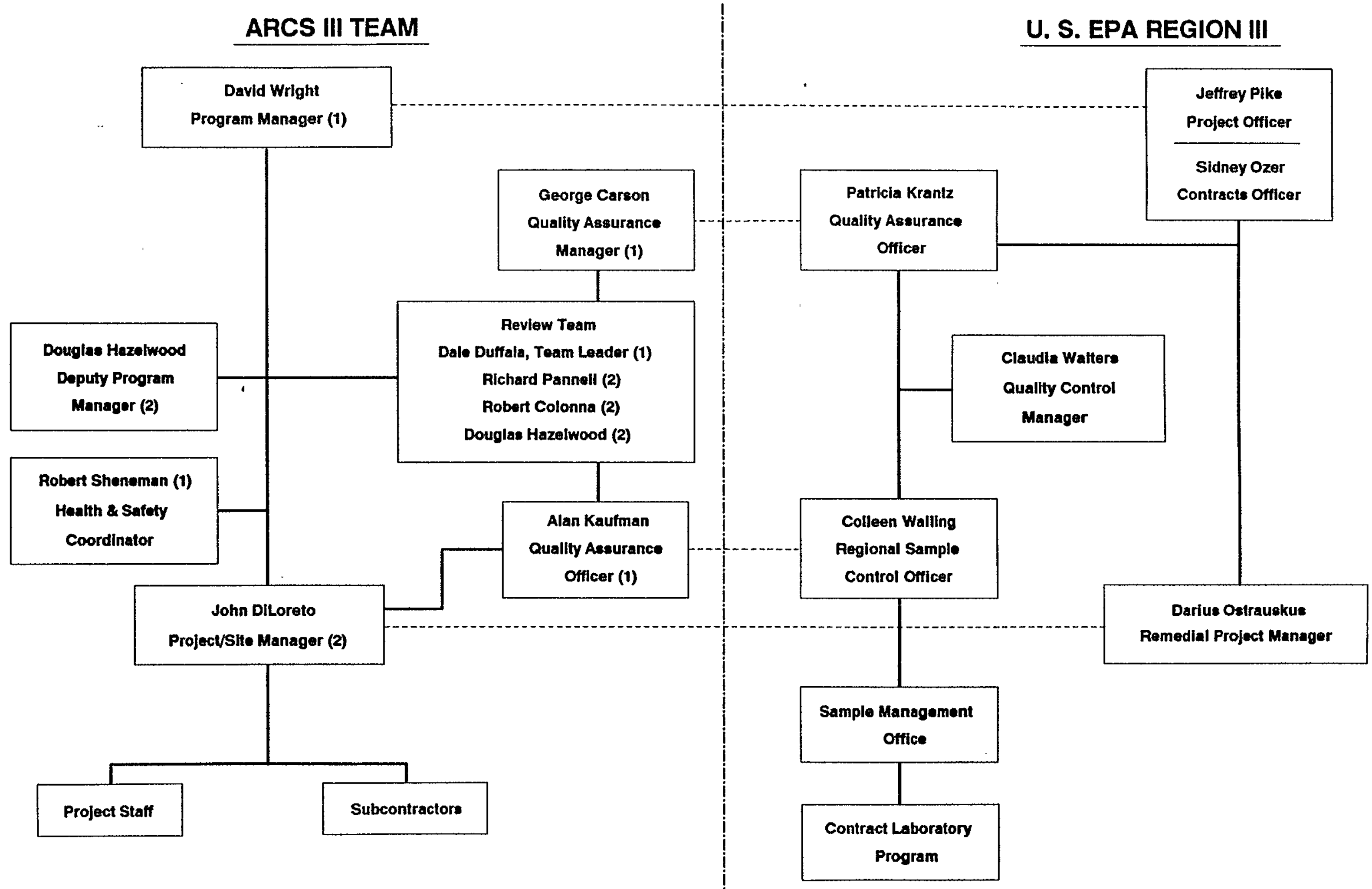

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Figure 4-1
Project Organization Chart

2. Providing administrative and oversite functions to the TETC ARCS Team members.

3. Coordinating problem resolution with the Program Manager.

4.3 QUALITY ASSURANCE MANAGER

The Quality Assurance Manager (QAM) for all ARCS III projects is George Carson (B&V). Mr. Carson has the primary responsibility for ensuring that all data, reports, and other deliverables meet the QA objectives associated with work assignments involving performance and/or environmental measurements. The Quality Assurance Manager is also responsible for all data processing activities, data processing quality control, final analytical data quality review, and internal audits. In addition, the QAM reviews and oversees the activities of the Review Team Leader and provides program-wide QA guidance and direction.

4.4 PROJECT/SITE MANAGER

Mr. John DiLoreto (TETC) is the Project/Site Manager for Brown's Battery Breaking Site. As both Project and Site Manager, Mr. DiLoreto is responsible for the implementation of the WP, SAP, H&SP and QAPjP developed for this site. This includes effective day-to-day management of all operations including:

1. Review and approval of sampling procedures and QA plans, including approval of monitoring site locations, data quality objectives, chemical analysis parameters, geophysical techniques, schedules, and manpower allocations.

2. Preparation of progress reports with the assistance of support personnel. Preparation of SAS requests in conjunction with the QAO.

3. Ensuring that corrective action, as detailed either in the QAPjP or as prescribed by the QAM, is undertaken when quality assessment results indicate the need for such actions.

4. Incorporating the Review Team Leader's comments in all project related work.

5. Verifying the accuracy of field notebooks, driller's logs, chain-of-custody records, sample labels, and all other field related documentation. Conduct internal QC reviews of the sampling and data reporting efforts.

6. Oversight of field personnel and subcontractor personnel for all sampling operations.

7. Conduct preliminary review of data and confirm only tentatively identified compounds.

4.5 REVIEW TEAM LEADER

The Review Team Leader (RTL) (B&V) for the Brown's Battery Breaking Site is Mr. Dale Duffala. The Review Team Leader is responsible for leading the overall quality of the QA effort. The RTL participates in all phases of the project and solicits and coordinates the activities of the review team. The Review Team for Brown's Battery includes Mr. Robert Colonna (TETC), Mr. Richard Pannell (TETC)and Mr. Doug Hazelwood (TETC).

Specifically, the duties of the RTL include:

1. Reviewing each document prepared under each work assignment for the quality of the data referenced in the document and the validity of the conclusions derived.

2. Providing technical advice and direction to the Project Manager in developing and implementing the environmental assessment.

4.6 HEALTH AND SAFETY COORDINATOR

Mr. Robert Sheneman (B&V) will serve as the project Health and Safety Coordinator (HSC). In this capacity, Mr. Shenenman has primary responsibility for the personal safety of all site personnel. The HSC is tasked with the preparation of a Health and Safety Plan (HSP). This plan details the required standard operating procedures (SOP's) regarding site safety. A site Health and Safety Officer (HSO) will be designated to monitor the labeling, shipping, and control of hazardous or potentially hazardous samples onsite. In addition, the HSO will be responsible for daily health and safety briefings for all field personnel.

4.7 REMEDIAL PROJECT MANAGER

Mr. Darius Ostrauskus is the EPA Remedial Project Manager (RPM) for the Brown's Battery Breaking Site. Mr. Ostrauskus will guide the Remedial Investigation and Feasibility Study (RI/FS) effort and have final approval of project planning documents, field activities and all related project deliverables. Mr. Ostrauskus' chief point of contact at TETC is Mr. John DiLoreto, the project and site manager.

4.8 EPA REGION III QUALITY ASSURANCE OFFICER

Ms. Patricia Johnson Krantz is the chief of the Quality Assurance Section, EPA Region III, for the Central Regional Laboratory (CRL). In this capacity, Ms. Krantz is responsible for the overall direction of the CRL/CLP laboratory QA program. In the capacity of CRL Quality Assurance Officer (CRL/QA), Ms. Krantz is charged with resolving conflicts regarding laboratory QA/QC issues.

4.9 LABORATORY QUALITY CONTROL MANAGER

Ms. Claudia Walters, EPA Region III, CRL Quality Assurance Division, is assigned to the Brown's Battery Project. Ms. Walters can be reached at Central Regional Laboratory, 839 Bestgate Road, Annapolis, MD, 21401, (301) 266-9180.

4.10 LABORATORY SAMPLE CONTROL OFFICER

Ms. Colleen Walling is the manager of the Regional Sample Control Center (RSCC) of Region III EPA. She is also the Sample Management Office's (SMO) Regional Representative and will handle all Routine Analytical Services (RAS) and Special Analytical Services (SAS) requests as well as questions related to sample handling or shipping. Ms. Walling can be reached at the same address and phone number listed above for the CRL.

4.11 QUALITY ASSURANCE OFFICER

Mr. Alan Kaufman (B&V) will serve as the Quality Assurance Officer (QAO). Mr. Kaufman's functions will include the review of all SAS requests, confirmation of any tentatively identified compounds and ordering sample containers. Mr. Kaufman will serve as the project liaison with the Regional Sample Control Center (RSCC). Mr. Kaufman will work closely with the PM/SM to coordinate sampling and analytical efforts.

SECTION 5.0

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATIVENESS, COMPARABILITY, AND COMPLETENESS

5.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATIVENESS, COMPARABILITY, AND COMPLETENESS

All measurements required for the Brown's Battery Breaking Site will be completed in a manner which ensures that analytical results are representative of the media and conditions measured. Unless otherwise specified, all data will be calculated and reported in units consistent with other organizations reporting similar data to allow comparability of data bases among organizations. Data will be reported in ug/l and mg/l for aqueous samples, ug/kg and mg/kg (dry weight) for soil samples, and ug/m^3 and mg/m^3 for air samples.

5.1 OVERALL PROJECT OBJECTIVES

The Brown's Battery Breaking Site is contaminated principally by lead and possibly other heavy metals. The data collection during the RI will be used to determine the extent of contamination and potential for release to environmental receptors. The exposure pathways to be evaluated include potential contamination of drinking water supplies, possible contamination of the food chain, particular the aquatic food chain, and intake from airborne contamination. The dermal/oral intake of contaminated soil will also be investigated.

The sampling and analyses and associated quality assurance efforts are aimed at ensuring that these objectives are achieved in a technically acceptable, timely, cost-effective, and safe manner. The specific data quality objectives (DQOs) associated with each sampling episode are described below. When combined, these individual DQOs assure the quality of the overall project.

5.2 FIELD INVESTIGATION QUALITY OBJECTIVES

The following sections describe the data quality objectives which will be applied to the field operations at the site.

5.2.1 DQOs for Phase I, Soil Sampling

Soil sampling will be used to establish current soil lead concentrations, both aerially and with depth, outside of the Containment Area. The sampling will be used to identify hot spots or zones of contamination remaining on the site following the IR. The goal for this sampling episode is to obtain contaminant information which will be used during the subsequent soil evaluation and monitoring well installation. Information derived during the initial sampling will be used, if indicated, to modify the Phase II soil and ground water sampling sites.

A survey-established sampling grid, set on 100 foot intervals, will be field set on the site. Thirty soil sampling sites will be located and tested at two depths. A surface sample and deeper sample are described in Section 2.0 of the Sampling and Analysis Plan. All samples collected in this manner will be analyzed for lead concentration by x-ray fluorescence. Twenty percent of the samples will be analyzed for Target Compound List (TCL organics) and Target Analyte List (TAL inorganics). Table 5-1 lists target values for soil data quality characterizations.

5.2.2 DQO's for Final Siting of Phase II Soil and Monitoring Well Locations

Following the receipt and validation of the Phase I soil data, the final sites for both Phase II soil sampling and monitoring well locations will be identified. This task will be accomplished jointly between the PM and RPM. The final locations will be based upon the Phase I results, historic site information, and professional judgement, to locate sites in "hot" spots or to better characterize contaminated zones or groundwater flow characteristics.

5.2.3 DQO's for Soil Engineering Parameters (optional)

The goal of this sampling episode is to define soil engineering parameters that are important in evaluating various remediation techniques. These samples may be taken during Phase II.

The DQOs for this sampling and analysis episode are to:

- o Determine bulk density of site soils in accordance with accepted engineering practices.
- o Define the particle size distribution of site soils to within acceptable engineering standards.
- o Determine soil moisture and total organic matter content.
- o Estimate the amount and type of debris that will need to be treated and/or disposed from the site.

TABLE 5-1

TARGET VALUES FOR SOILS DATA QUALITY CHARACTERISTICS

Test	Test Method	Precision (Relative %) Difference	Accuracy (% Recovery)	Completeness (%)
ICP Screen (TAL)	SW3050/ SW6010	80	60-140	80
EP TOX	SW 1310	80	60-140	80
Lead	SW 3050/ SW 7420	80	60-140	80
Bulk Density	ASTM D1556-82	N/A*	N/A	70
Particle Size Analysis	ASTM D422-63	N/A*	N/A	70
Permeability	SW 9100	N/A*	N/A	70
Unconfined Compressive Strength	ASTM D2166-85 ASTM D1633-84	25*	N/A	70
Organic Matter	ASTM 2974-87	N/A*	N/A	70

Key:

ASTM = American Society for Testing and Materials, 1988.

SW = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW 846, 3rd, Edition, USEPA 1986.

SM = Standard Methods for Examination of Water and Wastewater, 16th Edition, 1985.

Note: Engineering parameters will be part of Phase II.

* Physical tests rely primarily upon frequent equipment calibration to assess data quality. Precision and accuracy (bias) values have not been conclusively established as of 1989. Precision values presented are advisory only.

- o Determine soil pH.
- o Determine soil porosity.

5.2.4 DQOs for Testing Stabilized or Treated Samples

The purpose of this sampling and analysis episode is to evaluate treatability samples for reduction of contaminant mobility, toxicity or volume. EP TOX levels, as defined in 40 CFR 261.24, will be an indicator of successful treatment. In addition, other tests will be performed on the treated samples to assess performance. The Work Plan for this site includes stabilization/solidification and soil washing as alternative treatment methods which will be evaluated as part of the RI/FS effort.

The DQOs to achieve these goals are to:

- o Determine the EP TOX levels of the stabilized or treated samples.
- o Determine lead and antimony concentrations in the treated samples for comparison with untreated samples.
- o Determine engineering parameters (permeability, unconfined compressive strength, durability) of the stabilized or treated samples in accordance with accepted engineering practices to support the ultimate disposition of the treated waste material.

5.2.5 DQOs for Ground Water Monitoring

The objectives of this sampling episode are to supplement historical site groundwater data and to determine if ground water at or near the site has been contaminated with lead or other Target Analyte List metals (TAL) since the last ground water sampling episode in 1984. Information obtained from existing monitoring wells will be used, when possible, to help define the positions of the eight additional monitoring wells planned for this site. The combined data collected from all the wells on the site will be used to define the site hydrogeologic conditions with respect to groundwater flow, depth to aquifer(s), and background or site contamination. DQOs to achieve these goals are:

- o Redevelop the three existing monitoring wells.

- With data obtained from Phase I soil sampling and prior sampling of the existing monitoring wells, locate final sites appropriate for the four new monitoring wells.

- Develop and test the water quality in each monitoring well onsite, utilizing both filtered and unfiltered water samples. All samples will be analyzed for lead concentration.

- Sample residential wells (unfiltered only) for TAL/TCL.

- Determine TAL metals for 20% of all ground water samples taken.

- Determine the TCL (organic) concentrations for 10% (minimum) of all groundwater samples taken.

Table 5-2 summarizes the target values for water data quality characteristics.

TABLE 5-2

TARGET VALUES FOR WATER DATA QUALITY CHARACTERISTICS

Test	Test Method	Precision (Relative %) Difference	Accuracy (% Recovery)	Completeness (%)
ICP Screen	SW 3005/ SW 6010	20	70-120	90
Lead (total)	SW 3005/ SW 7421	20	70-125	90
Antimony (total)	SW 3005/ SW 7041	20	70-125	80

Key:

ICP or Analysis for Metals = Inductively Coupled Plasma Atomic Emission Spectroscopy

7.0 SAMPLE CUSTODY

The primary objective of sample custody procedures is to create an accurate written record which can be used to trace the possession and handling of all samples from the moment of their collection, through analysis, until their final disposition. All procedures for sample labeling, handling, and reporting will comply with EPA approved labeling and chain-of-custody methods. Examples of an EPA sample container label, EPA traffic report for inorganics, EPA field chain-of-custody record, custody seal, sample tag and packaging list are contained in Figures 7-1 through 7-3 located at the end of this section. Organic traffic reports will also be used during the Brown's RI/FS. Laboratory custody procedures will specifically follow CLP procedures outlined in the CLP Statement of Work, Exhibit F, (December 1987).

An individual sample identification (ID) number is assigned to each sample collected in the field to distinguish matrix, site location, and a discreet sample number. Environmental samples collected as part of this RI/FS include:

- Soil
- Well Water (ground water from monitoring wells and drinking water wells)
- Surface Water (creek and river)
- Sediments
- Bioassessment Samples (<u>Corbicula</u> sp. Tissue)

Samples will be labelled using a three (3) part code as follows:

e.g. S-T22-17

1. Matrix definition: Soil (S)
   Ground water (GW) (Monitoring Wells)
   Tap Water (TW) (Drinking Water Wells)
   Surface Water: Schuylkill River (SR) or Mill Creek (MC)
   Sediment (SD)
   Tissue Sample (TS)

2. Location collected: grid coordinates of soil samples (letter/number)
   well number
   site number of surface water/sediment sampling sites/bioassessment sites

3. Sample number: Discreet number of sample taken from that position or the depth of soil sample in inches.

The CLP laboratory will also assign an unique code which identifies each sample, analytical batch number and the client. By utilizing these two ID numbers, each sample can be tracked from the initial field book entry and sample tagging through shipment and receipt at the analytical laboratory and finally to laboratory data summary sheets.

The field book entry protocol is described in detail in Chapter 6.0, "Sample Collection".

The PM will issue the sample logbooks at the beginning of each sampling day and collect and secure these records of field activities at the end of each sampling day.

Sample Custody

In order to maintain and document sample custody, the following chain-of-custody procedures will be strictly followed. A sample is considered to be under custody if:

- o It is in actual possession of the responsible person.
- o It is in view, following physical possession.
- o It is in possession of a responsible person and is locked or sealed to prevent tampering.
- o It is in a secure area, such as a locked room or locked vehicle.

By this definition, the ARCS team member collecting the samples is responsible for care and custody of the samples until transferred to the QAO or their designee.

Sample Tags

Samples are identified by a sample tag. The information recorded on the sample tag includes:

Project Code	-	WA 91-01-3684
Station no. and Location	-	The sampling location as specified by the PM, for example: F5
Date	-	The date in MM/DD/YY format, for

example: 12/05/89 is December 5, 1989.

Time	-	The time of collection in 24-hour clock format, for example: 0954 is 9:54 a.m. and 1847 is 6:47 p.m.
Sample Type	-	i.e., grab or composite
Media	-	The matrix of the sample, for example: Soil
Preservation	-	Check "Yes" or "No" as appropriate
Sampler(s)	-	Print the NAME(s) of the sampler(s) on the tag
Analysis	-	Check appropriate box, for example: metals
Sample ID Number	-	Write the number of the sample.

After adding the information to the tag, it is attached to the sample and placed in the shipping container.

<u>Chain-of-Custody Record</u>

Sample custody is maintained by a "Chain-of-Custody Record." The custody record is completed in duplicate by the individual designated by the PM as being responsible for sample shipment. The information recorded on this record includes:

Project Number	-	The number of the project, for example: WA91-01-3684
Project Name	-	The title of the project, for example: Browns Battery
Collected by	-	Print the name(s) of the sampler(s) on the form
Sample No.	-	Write the number of the sample
Date/Time Collected	-	Record the date and time of the sample collection
Composite/ Grab	-	Indicate whether the sample is a composite or grab sample

Containers	-	Indicate the number of containers and type, for example: glass
Sample Location	-	Print the location, for example: Battery Breaking Building
Analysis Required	-	Print the type of analysis required, for example: SW 6010
Remarks	-	Include additional information, e.g., cross-reference sampling numbers.
Relinquished by	-	Signature of the person giving up the sample
Date/Time	-	Print the date and time at which the sample was given up
Received by	-	The signature of the receiving person is required
Special Shipment/ Handling/Storage Requirements	-	Write any appropriate remarks.

Transfer of Custody

When transferring the possession of samples, the individuals relinquishing and receiving will sign, date and note the time on the record. This record documents the transfer of samples from the custody of the sampler to that of another person, or the permanent laboratory. All such packages will be accompanied by the chain-of-custody record, which identifies the contents. A copy of the record will accompany the shipment, and a copy will be retained by the Project/Site Manager or his designee. The duplicate custody record will have the signature of the relinquishing field technician and a statement of intent such as "to Purolator (Baltimore Office) p.m. 11/5/88."

The relinquishing individual will record specific shipping data (airway bill number, office, time, and date) on the original and duplicate custody records. It is the Project/Site Manager's responsibility to ensure that all records are consistent and they are made part of the permanent job file.

If sent by mail, the package is registered with return receipt requested. If sent by common carrier, a bill of lading is used. Freight bills, postal service receipts, and bills of lading are retained as part of the permanent documentation.

The chain of custody is maintained from the time of sample collection through possible delivery as evidence in court.

Sample Packaging

All samples will be packaged in compliance with current U.S. Department of Transportation (DOT) regulations and to avoid breakage or contamination. Samples will be shipped to the laboratory at proper temperatures to ensure sample preservation. The following sample packaging requirements will be followed:

- Sample bottle lids are never to be mixed. All sample lids must stay with the original containers. Custody seals must be affixed when the samples are placed into containers.

- Unless otherwise specified, all sample bottles must be secured with a custody seal and placed in a plastic bag to minimize the potential for vermiculite contamination. Custody seals are preprinted adhesive-backed seals with security slots designed to break if the seals are disturbed. The custody seal is placed over the cap of individual sample bottles by the sampling technician.

- The secured sample bottles must be placed in the cooler in such a way as to ensure that they do not touch one another.

- Empty space in the cooler should be filled in with inert packing material. Under no circumstances will locally obtained material (sawdust, sand, etc.) be used.

- The original custody record must be placed in a plastic bag and taped to the bottom of the cooler lid.

- All shipping containers will be custody-sealed for shipment to the laboratory. Procedures include wrapping custody seals across the edge of the shipping container lid. Two seals will be used per shipping container. Filament tape will be wrapped around the package at least twice. The seal will be signed before the sample(s) is shipped.

- Shipping coolers will have a clearly visible return address.

Sample shipment destination will be as follows:

Sample	Type of Analysis	Ship to
Soil, sediment surface water, ground water, bioassay tissue	Physical Testing and Analytical Chemistry (RAS & SAS Requests)	CLP-designated laboratory

Packaging of Low Hazard Samples

Low-hazard samples are defined as environmental or containing less than 10 ppm of any single constituent. All low hazard aqueous samples contaminated with organics will be cooled. Cooling of low hazard samples for inorganic analysis is optional. "Blue ice" or some other artificial icing material is preferred. If unavoidable, ice may be used, provided that it is placed in 3-mil plastic bags and secured. Ice is not to be used as a substitute for packing material. Ice will not be used when shipping low hazard soil samples or samples contaminated with inorganics.

Shipping coolers will be lined with heavy, plastic garbage bags. A three-inch thick layer of vermiculite or zonolite will be added to the bottom, followed by containerized ice or "blue ice" around the samples. Vermiculite or other inert filling material will be placed above the samples. Standard Coleman-type coolers will be used.

Packaging of Medium-Concentration Samples

Medium concentration samples are defined as containing between 10 and 150,000 ppm of any constituent, or a sample with direct but diluted contamination, material from previous spills, or discolored solid matrices or turbid liquids. All medium-hazard samples must first be placed in paint cans containing sufficient vermiculite, zonolite or other inert materials, to cushion the sample containers and absorb spills. These paint cans are sealed, properly labeled, and placed in the cooler or other appropriate shipping container. Medium-hazard samples are not to be cooled with ice or other artificial icing materials.

Packaging of Biologic Samples

The viscera of all aquatic biologic samples will be wrapped in aluminum foil, sealed in a watertight plastic bag, and cooled as above. If possible, samples will be frozen for shipment. Freezing will only be attempted if the samples will not undergo freezing and thawing during transit.

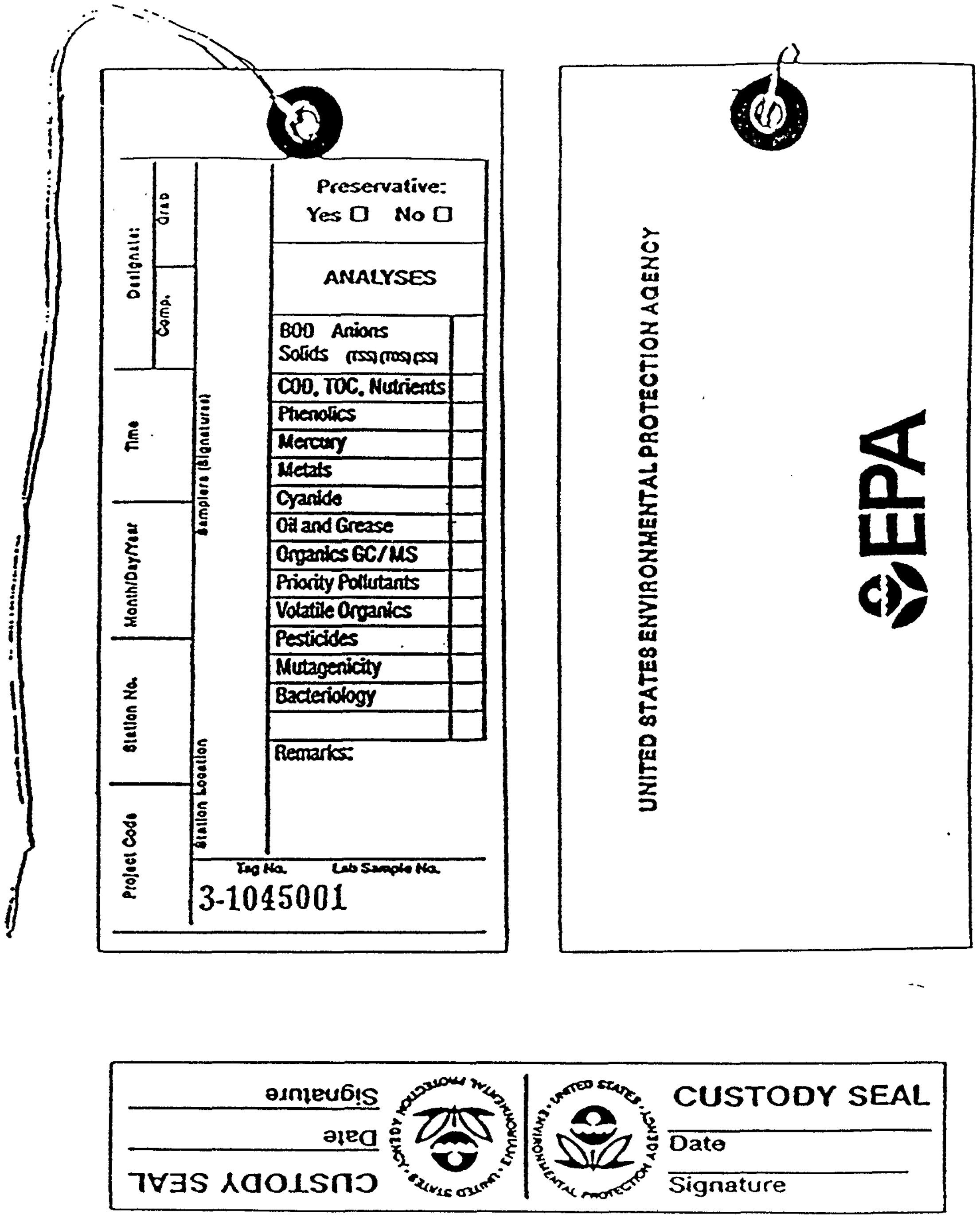
Shipment Coordination with the Sample Management Office (SMO)

The EPA Sample Management Office (SMO) will be notified immediately following all sample shipments. Information to be conveyed to the SMO includes:

- Sampler name
- Case Number of the project
- Exact number(s) and type(s) of samples shipped
- Laboratory(ies) samples were shipped
- Carrier and airbill number(s) for shipment
- Method of shipment (for example, overnight)
- Date of shipment
- Any irregularities or anticipated problems with the samples, deviations from established sampling procedures
- Status of the sampling project (for example, final shipment, or give update of future shipping schedule).

Receipt of Samples

All samples received by the CLP-designated laboratory will be checked for label identification and accurate, complete chain-of-custory records. Each sample will be assigned a unique laboratory identification number. This number will allow tracking of the sample from storage through the laboratory system until the analytical process is complete and the sample is returned to the ARCS team.



	WA 91-01-3684

Figure 7-1

Sample Container Label
EPA Custody Seal

300440

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME

SAMPLERS: (Signature)

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS								REMARKS

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

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Figure 7-2
EPA Chain of Custody Record

USEPA CONTRACT LABORATORY PROGRAM
SAMPLE MANAGEMENT OFFICE
P.O. BOX 818 ALEXANDRIA, VA 22313
703/557-2490 FTS-557-2490

CASE NO:

SAS NO:
(IF APPLICABLE)

INORGANIC TRAFFIC REPORT

(FOR CLP USE ONLY)

TYPE OF ACTIVITY (CIRCLE ONE) ①
SUPERFUND—PA SI ESI RIFS RD RA ER
NPLD O&M OTHER______
NON-SUPERFUND—__________PROGRAM

SITE NAME:

CITY, STATE: SITE SPILL ID:

REGION NO: SAMPLING COMPANY ②

SAMPLER (NAME)

SHIP TO: ③

ATTN:__________

SAMPLING DATE: ④

BEGIN:__________ END:__________

DATE SHIPPED:______ CARRIER:______ ⑤

AIRBILL NO:__________

SAMPLE DESCRIPTION ⑥
(ENTER IN BOX A)
1. SURFACE WATER
2. GROUND WATER
3. LEACHATE
4. SOIL
5. SEDIMENT
6. OIL (SAS)
7. WASTE (SAS)

DOUBLE VOLUME REQUIRED FOR MATRIX SPIKE/DUPLICATE AQUEOUS SAMPLE

SHIP MEDIUM AND HIGH CONCENTRATION SAMPLES IN PAINT CANS

SEE REVERSE FOR ADDITIONAL INSTRUCTIONS

CLP SAMPLE NUMBER (FROM LABELS)	⑧ SAMPLE DESCRIPTION (FROM BOX 6) 1 2 3 4 5 6 7	⑨ CONCENTRATION L = LOW M = MED H = HIGH (SAS)	⑩ RAS ANALYSIS: TOTAL METALS	CYANIDE	DISSOLVED METALS	HIGH ONLY (SAS):				⑪ SPECIAL HANDLING	⑫ STATION LOCATION

EPA Form 2075-6 (8-87)

WHITE — SMO COPY PINK — CLIENT COPY WHITE — LAB COPY FOR RETURN TO SMO YELLOW — LAB COPY

WA 91-01-3684

Figure 7-3

EPA Traffic Report Form

300442

5.2.6 DQO's for Surface Water and Sediment Sampling

Both surface water and sediment samples will be collected at each sampling point identified in Mill Creek and the Schuylkill River. (See SAP, Figure 6-2.) The following objectives will be applied to this sampling event:

- Determine TAL (metals) content in each filtered and unfiltered surface water sample.
- Determine TCL (organic) contents of 20% of all water samples taken.
- Determine total suspended solids (TSS), temperature, dissolved oxygen (DO), Eh, pH and conductance of all unfiltered water samples taken.
- Determine alkalinity and hardness of all filtered and unfiltered water samples.
- Determine lead content, pH, total organic carbon (TOC), temperature, and conductance for all sediment samples collected.
- Determine TAL and TCL and antimony content of 20% of all sediment samples taken.

5.2.7 DQO's for Bioassessment Study

Both aquatic and terrestrial biologic samples will be collected as part of this sampling effort. Tissue analyses tests will be conducted on selected species (Corbicula sp.) collected from Mill Creek and the Schuylkill River. All biologic samples will be analyzed for lead concentrations.

5.3 LABORATORY QUALITY OBJECTIVES

The Contract Laboratory Program (CLP) quality objectives are to provide consistent results of known and documented quality. Stringent QC requirements are placed on all laboratories participating in the CLP. In addition to these QA/QC procedures, each laboratory is encouraged to develop additional internal QA/QC procedures. The initial and ongoing evaluation of participating laboratories ensures that acceptable precision and accuracy are maintained. Specific laboratory QC procedures for the CLP can be found in the CLP Statement of Work, (SOW) Exhibit E, December 1987 and July 1987.

CLP QC procedures require the use of laboratory control samples, blanks, duplicate samples, calibration checks and matrix spike sample recoveries for the evaluation of laboratory precision and accuracy. The frequency and application of QC sample analysis is further defined in the CLP SOW.

5.4 CHARACTERISTICS OF DATA QUALITY

Data quality characteristics include precision, accuracy, representativeness, completeness and comparability. These characteristics are defined as follows:

Precision

Precision is the degree of mutual agreement between numeric values for two or more measurements which have been made in an identical fashion.

Accuracy

Accuracy is the degree of agreement of a measurement with an accepted "true" value, and is a measure of bias in the system.

Representativeness

Representativeness expresses the degree to which data accurately and precisely represent selected characteristics.

Completeness

Completeness is a measure of the amount of the valid data obtained from the measurement system compared to the amount that was expected under normal conditions.

Comparability

Comparability expresses the confidence with which one data set can be compared to another. All data for soil samples will be reported in mg/kg or ug/kg, dry weight. Data for aqueous samples will be reported in mg/l or ug/l. These reporting units are comparable with data already collected by EPA On Scene Coordinator report, (Ref. 2)

5.5 DATA MANAGEMENT OBJECTIVES

The objective of the data management program is to provide a useful and complete data base. In order to be considered "useful", the data must first be accurately logged and compiled into a comprehensive and consistent form. The final reporting of data collected at Brown's Battery will summarize:

- Sample type
- Sample locations
- Number of samples
- Sampling procedures
- Media
- Analytical methods
- QC samples
- ARCS sample numbers
- Laboratory sample ID numbers
- Holding time

SECTION 6.0

SAMPLING PROCEDURES

6.0 SAMPLING PROCEDURES

All sampling procedures referenced or described in this manual are consistent with EPA procedures. A complete description of the sampling procedures employed on the Brown's Battery Breaking Site are outlined in the SAP, sections 2.0 through 5.0. Procedures for each sampling method are presented within the framework of the intended data quality goals.

During the course of the sampling effort, environmental samples to be collected will include surface soil, subsurface soil, ground water, surface water, Corbicula sp. tissue and sediments. In addition, soil/battery material will be collected for conducting treatability analysis. Non-galvanized metal (316 or 304 stainless steel) trowels, shovels, and bucket augers will be used to collect soil samples from this site. Disposable plastic spoons will also be used to aid soil sample collection. Ground water samples will be collected using a teflon bailer. Surface water samples will be collected using a Wheaton sampler. Sediment grabs will be taken with an Ekman dredge sampler. Corbicula, sp. Clams will be collected using the Ekman dredge sampler and trowles, as necessary.

Wipe samples, using wetted filter paper, will be taken from vehicles leaving the site to ensure proper decontamination procedures. Once the contamination level of monitoring well development water, and drill cutting are known, the PM and RPM will evaluate disposal options.

To prevent cross contamination of the collection implements, all sampling devices will be decontaminated or disposed of between sampling points according to the procedures outlined in section 7.0 of the SAP.

The Regional Sample Control Center (RSCC) is the source of all sample containers used throughout this project. The QAO will be the liaison with the RSCC. In this capacity, the QAO will order the appropriate sample containers and reagents, and place SAS/RAS requests. Preservatives will be obtained through I-Chem Research and distilled reagent-grade water will be obtained through Baxter Health Care Products.

The frequency of sample shipment will be determined by the holding and preservation limitations for the analytes of interest and the number of samples being collected during each sampling day. Samples will be sent by air express at the end of each sampling day or as determined by the PM. Sample shipment will follow the packing and labeling procedures outlined in chapter seven of this document, entitled "Sample Custody".

Table 6-1 presents the recommended sample storage, preservation, and holding times, according to sampling procedures, for the site.

Daily Logs

All information pertinent to a field survey and/or sampling will be recorded in a logbook which will be a waterproof, bound book, preferably with consecutively numbered pages. Entries in the logbook will be made in water-resistant ink, and will include the following:

- Names and affiliations of personnel on site.
- General description of each day's field activities.
- Documentation of weather conditions during sampling.
- Location of sampling (station number as description).
- Sample depth.
- Name and address of field contact (in cover of logbook).
- Type of sample matrix (e.g., soil, groundwater, etc.).
- Date and time of collection.
- Collector's sample identification number(s).
- Sample distribution (e.g., laboratory, hauler, etc.).
- Observations of sample or collection environment, if needed.
- Any field measurements made such as pH, flammability, etc.
- Sampler's name.
- Sample type (composite, split, etc.).

Photographs

Photographs will be recorded in the appropriate logbook section or, in additional sections as needed. Information to be recorded includes:

- Roll and frame number
- Date
- Time
- Photographer
- Location, i.e., "west side of containment area"
- Subject, i.e., "installation of borehole XX"
- Significant features, including weather.
- Names of any personnel included in the photograph.

Table 6-1
Sample Volume, Preservation, Holding Time and Container Requirements

Sample Type	Matrix	Method	Sample Vol./Mass	Container	Preserv.	Holding Time
Physical Parameters						
Conductance/TSS	W	Meter	N/A	N/A	N/A	No Holding (field test)
pH	S	SW 9045	N/A	N/A	N/A	No Holding (field test)
	W	pH meter	N/A	N/A	N/A	No Holding (field test)
Eh	W	Eh meter	N/A	N/A	N/A	No Holding (field test)
Total Organic Carbon	S	SW 9060 (CLP-M 415.13)	1 liter	G preferred	HC1 to pH <2	28 days
Metals						
Lead	S	XRF	6 oz.	P,G	N/A	6 months
Lead (Total Recoverable) (Dissolved)	W	SW 3005/ SW 7421 (239.2 CLP-M)	1 liter 1 liter	P,G P,G	HNO_3 to pH <2 Filter on-site; HNO_3 to pH <2; Cool to 4°C	6 months 6 months

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Table 6-1 (continued)
Sample Volume, Preservation, Holding Time and Container Requirements

Sample Type	Matrix	Method	Sample Vol./Mass	Container	Preserv.	Holding Time
Lead	B	SW 7421 (239.2 CLP-M)	10-15 organisms per site	foil	Cool to 4°C	24 hours
Antimony (Total Recoverable) (Dissolved)	W	SW 3005/ SW 7041 (204.2 CLP-M)	1 liter 1 liter	P,G P,G	HNO_3 to pH <2 Filter on-site; HNO_3 to pH <2	6 months 6 months
TAL (ICP Screen)	S	SW 3050/ SW 6010 (200.7 CLP-M)	6 oz.	P,G	N/A	6 months
	W	SW 3005/ SW 6010 (200.7 CLP-M)	1 liter	P,G	Cool, 4°C	24 hours
<u>Inorganic, Non-Metallic</u>						
Dissolved Oxygen	W	D.O. meter	N/A	N/A	N/A	No Holding (field test)
Hardness	W	E 130.1	1 liter	P	HNO_3 to pH<2	6 months
Alkalinity	W	E 310.1	1 liter	P	Cool to 4°C	14 days

Table 6-1 (continued)
Sample Volume, Preservation, Holding Time and Container Requirements

Sample Type	Matrix	Method	Sample Vol./Mass	Container	Preserv.	Holding Time
TCL (Organic) Parameters						
Volatile Organics	S	CLP after EPA Method 624	6 oz	G only	Teflon-faced glass VOA vials Cool to 4°C	14 days
	W	CLP after EPA Method 624	2-40 ml	G only	Teflon-faced, glass VOA vials. Cool to 4°C, Eliminate free air space.	10 days
BN/A Semi-Volatile Organics	S	CLP after EPA Method 625	6 oz	G only	Teflon-faced, Cool to 4°C, Eliminate free air space.	14 days
	W	CLP after EPA Method 625	1 gallon	(amber) G only	Teflon-faced vial. Cool to 4°C	7 days

300428

Table 6-1 (continued)
Sample Volume, Preservation, Holding Time and Container Requirements

Sample Type	Matrix	Method	Sample Vol./Mass	Container	Preserv.	Holding Time
Organochlorine Pesticides and PCBs	S	CLP after EPA Method 608	6 oz	G only	Teflon-faced glass vials, cool to 4°C	14 days
	W	CLP after EPA Method 608	1 gallon	(amber) G only	Teflon-faced glass vials, cool to 4°C	7 days

Key:

1. W = Water, S = Sediment or Soil, B = Biologic Samples

2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

3. The listed holding times are recommended for properly preserved samples based on currently available data. It is recognized that extension of these times may be possible for some sample types while, for other types, the times may be too long. When shipping regulations prevent the use of the proper preservation technique or when the holding time is exceeded, the final reported data for these samples should indicate the specific variance. If samples cannot be analyzed within the specified time intervals, the final reported data should indicate the actual holding time.

Table 6-1 (continued)
Sample Volume, Preservation, Holding Time and Container Requirements

References include:

SM = Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985).

SW = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (USEPA 1986).

ASTM = American Society for Testing and Materials, (1988).

Required Containers, Preservation Techniques, and Holding Times, 40 CFR 136.3, Table II.

CLP = Contract Laboratory Program, S.O.W. TCL 7/87
S.O.W. TAL 12/87

U.S. Fish and Wildlife – "Multi-Element Analysis of Fish Tissue and Standard Referenced Matter Using ICP argon coupled plasma spectroscopy." See Appendix B.

SECTION 7.0

SAMPLE CUSTODY